

IN THE CLAIMS

1. (Currently amended) A magnetic random access memory MRAM device comprising:
a substrate;
a digit line extended in a first direction on a disposed over the substrate and extending in a first direction;
a bit line extended in a second direction on the substrate disposed over the digit line and extending in a second direction, the second direction being substantially perpendicular to the first direction; and
a magnetic memory cell disposed in an intersection between the digit line and the bit line, the magnetic memory cell including
an anti-ferromagnetic layer that is disposed over the digit line and that is electrically insulated from the digit line,
a fixed magnetic layer disposed in contact with an upper surface of the anti-ferromagnetic layer, the fixed magnetic layer having a fixed direction of magnetization,
a tunneling insulation layer disposed in contact with an upper surface of the fixed magnetic layer,
a rectangular free magnetic layer disposed in contact with an upper surface of the tunneling insulation layer and electrically coupled with the bit line, the free magnetic layer having a rectangular shape and configured to be magnetized in a direction according to an externally applied magnetic field, a major axis of the rectangular free magnetic layer being substantially parallel to the first direction, and a minor axis of the rectangular free magnetic layer being substantially parallel to the second direction; and
a word line disposed under the digit line, the word line extending substantially parallel to the first direction, the word line connected to the digit line.

2-3. (Cancelled)

4. (Currently amended) The magnetic random access memory MRAM device of claim 1, further comprising a word line extended in a substantially same direction as disposed under the digit line, the word line extending substantially parallel to the first direction and direction, the word line connected to electrically insulated from the digit line.

5. (Currently amended) The magnetic random access memory MRAM device of claim 1, the magnetic memory cell further comprising a switching element that is element.

the switching element configured to be switched by the word line to be electrically coupled with the fixed magnetic layer when the switching element is selected by the word line.

6. (Original) A multiple input/output magnetic random access memory device comprising:

a substrate having at least one block region, the at least one block region having a plurality of sub-block regions;

a plurality of digit lines extended in a first direction on the at least one block region, each of the digit lines being arranged along a second direction, the second direction being substantially perpendicular to the first direction;

a plurality of word lines arranged substantially parallel with the plurality of digit lines on the at least one block region;

a plurality of bit lines extended in the second direction on each of the sub-block regions, each of the bit lines being arranged along the first direction;

a plurality of magnetic memory cells disposed in intersections between the digit lines and the bit lines, the magnetic memory cells each including a rectangular free magnetic layer magnetized in a direction according to an externally applied magnetic field, a major axis of the rectangular free magnetic layer being substantially parallel to the first direction, and a minor axis of the rectangular free magnetic layer being substantially parallel to the second direction;

a row driver circuit that is configured to selectively activate the digit lines and the word lines, the row driver circuit being disposed at a first side of each of the block regions;

a first column driver circuit that is configured to selectively activate the bit lines for each of the sub-block regions, the first column driver circuit being disposed at a second side of each of the block regions;

a second column driver circuit that is configured to selectively activate the bit lines for each of the sub-block regions, the first column driver circuit being disposed at a third side of each of the block regions, the third side facing the second side;

a plurality of input/output lines; and

a sensing-and-writing driver circuit that is configured to selectively sense multiple bit lines for each of the sub-block regions to couple the sensed bit lines with the input/output lines, and configured to write data supplied from the input/output lines into corresponding multiple bit lines, the sensing-and-writing driver circuit being disposed between the second column driver circuit and the input/output lines.

7. (Original) The device of claim 6, the magnetic memory cell comprising:
a fixed magnetic layer having a fixed direction of magnetization, the fixed magnetic
layer disposed over the digit lines;
an insulation layer disposed on the fixed magnetic layer; and
the rectangular free magnetic layer disposed on tunneling insulation layer and
electrically coupled with the bit line.

8. (Original) The device of claim 6, the magnetic memory cell further
comprising an antimagnetic layer facing a lower surface of the fixed magnetic layer.

9. (Original) The device of claim 6, the magnetic memory cell further
comprising a switching element that is configured to be switched by each of the word lines to
be electrically coupled with the fixed magnetic layer when the switching element is selected
by the each of the word lines.

10. (New) The MRAM device of claim 1, the word line disposed in a region that
is directly under the digit line.

11. (New) The MRAM device of claim 5, the switching element comprising a
transistor having a drain electrode that is connected to the anti-ferromagnetic layer.